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**Kinetic Simulations of Piston-Driven Collisionless Shock Formation in Magnetized Laboratory Plasmas**[1] D.B. SCHAEFFER, Princeton University, W. FOX, PPPL, J. MATTEUCCI, K.V. LEZHNIN, A. BHATTACHARJEE, Princeton University, K. GERMASCHEWSKI, U. New Hampshire — Laboratory laser experiments offer a novel approach to studying magnetized collisionless shocks, and a common method in recent experiments is to drive shocks using a laser-ablated piston plasma. However, current experimental capabilities are still limited to spatio-temporal scales on the order of shock formation, making it challenging to distinguish piston and shock dynamics. We present quasi-1D particle-in-cell simulations [1] of piston-driven, magnetized collisionless shock formation using the code PSC, which includes a model of laser-driven plasmas that can be well-matched to experimental conditions. The simulations cover a range of upstream and downstream parameters, and yield several robust signatures of shock formation that can provide a reference for experiments where traditional characterizations of shocks, such as the Rankine-Hugoniot jump conditions, are not easily applied. The results indicate that there are three key timescales in the evolution of piston-driven shocks, from the formation of a shock precursor to the development of a well-defined downstream region, which can be identified through measurements of ion velocity distributions or careful observations of density and temperature profiles. [1] Schaeffer, et al., Phys. Plasmas 27, 042901 (2020).

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